Exercise 1: Playing with Definitions [2] (10/20 Points)

Consider the timed automaton $A$ in Figure 1.

(i) Give the abstract syntax corresponding to the graphical representation of $A$. (1)

(ii) Propose a formal definition of Zeno behaviour.

According to your definition: Does $A$ have a computation path with Zeno behaviour? (2)

(iii) Propose a formal definition of timelock.

According to your definition: Does $A$ have a computation path with a timelock? (2)

(iv) Does $A$ have a run? (2)

(v) Is the location $\ell_1$ reachable? And $\ell_2$? (3)

Note: And usual, don’t just state “yes” or “no” but convince your tutor of your claim by referring to the definition(s) relevant for the task.

Exercise 2: Playing with Uppaal\footnote{UPPAAL is installed in the pool, e.g. on login.informatik.uni-freiburg.de.} (10/20 Points)

Consider the Off/Light/Bright example from the lecture (Lec. 11, Slides 4-7).

(i) Provide an UPPAAL model for the system presented in the lecture. (3)

(ii) Does your model $\mathcal{M}$ have a run $\xi$ such that

\[
\xi \models_0 [\text{Off}]; ([\neg\text{Off} \lor []]; [\text{Bright}]; [\text{Off}]; ([\neg\text{Off} \lor []]; [\text{Bright}])
\]

Use the simulator to provide a trace demonstrating this fact. (4)

(iii) Modify (only) the user model to resemble a typical computer scientist: he considers bright lights irritating. The user should make sure that the Bright location is never reached. (3)

Note: Please provide all Uppaal files that are necessary to confirm your results: The models for tasks (i) and (iii) and the trace files for task (ii).

Exercise 3: Playing with Theory (5 Bonus)

Note that we used quotation marks to enunciate the property on exercise 3, task (ii), this is because the quoted mathematical expression has an intuitive meaning but we don’t have a formal semantics for it.

Explain why, what is missing? What needs to be done to be allowed to remove the quotation marks? Do that.
References
